

Curriculum vitae



Dr. Sumit Saroha
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Department of Electrical Engineering,
GJUS&T (Govt. of Haryana), Hisar,
Haryana, India
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Teaching

- Presently working as **Assistant Professor** in the **Department of Electrical Engineering** at **Guru Jambheshwar University of Science and Technology, Hisar, India** since September. 2018.

Academic Qualification

- **Doctorate of Philosophy** from MM University, Mullana (Amabla), India in Electrical Engineering Department with Registration No. 11-Ph.D-14.
- **M. Tech** from Deenbandhu Chhotu Ram University of Science & Technology, Murthal, India (2009-11) in Power System with CGPA 8.03/10 (Honours).
- **Bachelor of Engineering** from MDU, Rohtak, India (2008) in Electrical Engineering with 65.15% marks.

Ph.D. Thesis

- **Thesis Title:** Forecasting Issues in Present Day Power System (under the guidance of Dr. S. K. Aggarwal, Thapar University, Patiala, Punjab, India).

Patents

- **Title:** Universal Remote for Home Appliances, with Application No. 202031019501 in the field of Electrical Engineering.
- **Title:** IOT and Sensors Based System and Method for Artificial Kidney, with Application No. 202041034535 in the field of Bio-Medical Engineering.
- **Title:** Neural Network Based Solar Irradiance Forecasting Using Hybrid Wavelet Transform and PSO Technique, with Application No. 202211003320 A in the field of Electrical Engineering.
- **Title:** Solar Irradiation Prediction Framework Based on EEMD-GA-LSTM Method, with Application No. 202211003323 A in the field of Electrical Engineering.

Project (Under Progress)

- **Title:** Cost Effective Multifunctional Prosthesis for Disabled Persons under **RUSA 2.0, MHRD, Government of India** of amount **20 Lacs** Indian Currency.
- **Deputy Director & Startup Activity Coordinator** of **PDUIC, RUSA 2.0, MHRD, Government of India** at **GJUS&T, Hisar Centre**.
- **Faculty Co-Coordinator** of **AICTE-IDEA Lab** of worth **INR 1.10 Cr.** at the same.
- **Incharge Incubation Centre supported by DITECH, Govt. of Haryana** at **GJUST, Hisar Campus**

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M. Tech. Thesis & Training

- **Thesis Title:** Indian Cross Border Power Trading Model for Competitive Electricity Market (under the guidance of NPTI, Faridabad, India).
- **Training cum research:** National Power Training Institute, Faridabad, Under Ministry of Power, Govt. of India

Technical/Programming Skills

- Transformer Design, Electric Vehicles
- MATLAB, Wavelet Transform, Neural Networks, Statistical Data Analysis, Electricity Forecasting Issues (Electricity Price, Load, Wind Power and Solar Energy), Restructuring of Power System, Electricity Markets.

Specialization/Research Papers

- [1]. **Sumit Saroha** and Rohit Verma “Cross-border Power Trading Model for South Asian Regional Power Pool” *Elsevier International Journal of Electrical Power and Energy Systems* **2013**, *44*,146-152.
- [2]. **Sumit Saroha** and S.K. Aggarwal “Wind Power Forecasting Using Wavelet Transform and Linear Neural Network with Tapped Delay” *IEEE CSEE Journal of Power and Energy Systems*, **2018**, *4(2)*, 49-61.
- [3]. **Sumit Saroha** and S.K. Aggarwal, “Wind Power Forecasting Using Wavelet Transform and General Regression Neural Network” *Bentham Science Publishers Journal of Recent Advances in Electrical & Electronic Engineering* **2020**,*13*, 16-26.
- [4]. **Sumit Saroha**, Marta Zurek-Mortka, Jerzy Ryszard Szymanski, Vineet Shekher and Pardeep Singla, “Forecasting of Market Clearing Volume Using Wavelet Packet-Based Neural Networks with Tracking Signals”, *Energies* **2021**, *14(19)*, 6065.
- [5]. R Suresh, M Syed Ali and **Sumit Saroha**, “Global exponential stability of memristor based uncertain neural networks with time-varying delays via Lagrange sense”, *Journal of Experimental & Theoretical Artificial Intelligence* **2023**, *35 (2)*, 275-278.
- [6]. M. Syed Ali, R. Agalya, **Sumit Saroha**, and Tareq Saeed “ Leaderless Consensus of Non-linear Mixed delay Multi-agent Systems with Random Packet Losses via Sampled-data Control” *Springer International Journal of Control, Automation and Systems* **2020**, *18(X)* 1-9.
- [7]. Emel Arslan, G. Narayanan, M. Syed Ali, Sabri Arik, **Sumit Saroha**, “Controller design for finite-time and fixed-time stabilization of fractional-order memristive complex-valued BAM neural networks with uncertain parameters and time-varying delays”, *Elsevier Neural Networks* **2020**,*130*, 60–74.
- [8]. M. Syed Ali, M. Hymavathi, Grienggrai Rajchakit, **Sumit Saroha**, L. Palanisamy, and Porpattama Hammachukiattikul, “Synchronization of Fractional Order Fuzzy BAM Neural Networks With Time Varying Delays and Reaction Diffusion Terms” *IEEE Access* **2020**, *8*, 186551-186571
- [9]. M. Syed Ali, M. Hymavathi, **Sumit Saroha** and R. Krishna Moorthy, “Global asymptotic stability of neutral type fractional-order memristor-based neural networks with leakage term, discrete and distributed delays”, *Math Meth Appl Sci.* **2021**;1–21.

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- [10]. M. Syed Ali, G. Narayanan, **Sumit Saroha**, Bandana Priya and Ganesh KumarThakur, “Finite-time stability analysis of fractional-order memristive fuzzy cellular neural networks with time delay and leakage term”, Mathematics and Computers in Simulation 2021, 185, 468-485.
- [11]. Pardeep Singla, Manoj Duhan and **Sumit Saroha**, “A comprehensive review and analysis of solar forecasting techniques” Frontiers of Energy 2021, 1-37.
- [12]. Pardeep Singla, Manoj Duhan and **Sumit Saroha**, “An ensemble method to forecast 24-h ahead solar irradiance using wavelet decomposition and BiLSTM deep learning network”, Earth Science Informatics 2022, 15, 291-306.
- [13]. Pardeep Singla, Manoj Duhan, **Sumit Saroha**, “Review of Different Error Metrics: A Case of Solar Forecasting”, AIUB Journal of Science and Engineering 2021, 20(4), 158-165.
- [14]. Pardeep Singla, Manoj Duhan, **Sumit Saroha**, “A dual decomposition with error correction strategy based improved hybrid deep learning model to forecast solar irradiance, Energy Sources, Part A: Recovery, Utilization, and Environmental Effects 2022, 44(1), 1583-1607, DOI: 10.1080/15567036.2022.2056267
- [15]. Pardeep Singla, Manoj Duhan, **Sumit Saroha**, “A Hybrid Solar Irradiance Forecasting Using FullWavelet Packet Decomposition and Bi-Directional Long Short-Term Memory (BiLSTM)”, Arab J Sci Eng (2022), <https://doi.org/10.1007/s13369-022-06655-2>.
- [16]. Kalyan Singh, Sumit Saroha, Avnesh Verma, Priti Prabhakar, Krishan Kumar & Charanjeet Madan, “An Optimal Parameterized Fractional-Order PID Controller for the Single Phase Grid Integrated with Solar and Wind System”, Cybernetics and Systems, DOI: [10.1080/01969722.2022.2159163](https://doi.org/10.1080/01969722.2022.2159163).
- [17]. Pardeep Singla, Manoj Duhan & Sumit Saroha, “An integrated framework of robust local mean decomposition and bidirectional long short-term memory to forecast solar irradiance”, International Journal of Green Energy 2022. DOI: 10.1080/15435075.2022.2143272.
- [18]. Singla, P. ., Duhan, M. ., & Saroha, S. Performance Evaluation of Various Solar Forecasting Models for Structural & Endogenous Datasets. Distributed Generation & Alternative Energy Journal 2023, 38(02), 467–490. <https://doi.org/10.13052/dgaej2156-3306.3825>
- [19]. Anuj Gupta, Kapil Gupta, **Sumit Saroha**, “Solar Irradiation Forecasting Technologies: A Review” **Strategic Planning for Energy and the Environment 2020**, 39 (4), 319-354.
- [20]. Anuj Gupta, Kapil Gupta, **Sumit Saroha**, “Short Term Solar Irradiation Prediction Framework Based on EEMD-GA-LSTM Method” Strategic Planning for Energy and the Environment (2022), 41 (3), <https://doi.org/10.13052/spee1048-5236.4132>.
- [21]. Gupta, A., Gupta, K., & Saroha, S. Short Term Solar Irradiation Forecasting using CEEMDAN Decomposition Based BiLSTM Model Optimized by Genetic Algorithm Approach. International Journal of Renewable Energy Development 2022, 11(3), 736-750. <https://doi.org/10.14710/ijred.2022.45314>
- [22]. Anuj Gupta, Sharad Sharma and Sumit Saroha, “A new hybrid short term solar irradiation forecasting method based on CEEMDAN decomposition approach and BiLSTM deep learning network with grid search algorithm, accepted for publication in Distributed Generation and alternative energy Journal 2023; volume 38; Issue 4, 1-46.
- [23]. **Sumit Saroha** and S.K. Aggarwal “Hybrid WT-PSO Based Neural Networks for Wind Power Prediction of Ontario Electricity Market” International Journal on Electrical Engineering and Informatics 2015, 7, 237-249.
- [24]. **Sumit Saroha** and S.K. Aggarwal “A Review and Evaluation of Current Wind Power Prediction Technologies” WSEAS Transaction on Power System 2015, 10, 1-12.
- [25]. Sumit Saroha, Priti Prabhakar, “MCP Simulation and its Impact in Electricity Market”,

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- International Journal of Innovative Technology and Exploring Engineering*, **2019**, 8 (11), 1747-1751.
- [26]. **Sumit Saroha**, V.S. Gupta, Vineet Shekher, Preeti Rana, Pradeep Singla, “Promoting Short Term Load Forecasting by Using Artificial Intelligence” *International Journal of Engineering Applied Sciences and Technology*, **2017**, 2, 79-83.
- [27]. Vineet Shekher, V.S. Gupta, **Sumit Saroha** “Analysis of Fractional order PID controller for Ceramic Infrared Heater” *International Journal of Engineering Development and Research (IJEDR)*, **2016**, 4, 43-52.
- [28]. **Sumit Saroha**, V.S. Gupta, Vineet Shekher, “Role and responsibilities of power exchange in India” *International Journal of Engineering Development and Research (IJEDR)*, **2016**, 4, 53-55.
- [29]. Vineet Shekher, Nadeem, Akhilesh Kumar, **Sumit Saroha** “Analysis of Fuzzy Logic Controller for Temperature Control of Ceramic IR Heater” *International Journal of Trend in Research and Development* **2016**, 3, 167-169.
- [30]. **Sumit Saroha**, Hema Singh, Shalini Singh and Vineet Shekher “Transient Analysis for the Stability of Grid Connected Wind Turbine” *IFRSA International Journal of Electronics Circuits and Systems* **2016**, 5, 34-39.
- [31]. Kapil Dev Sharma, **Sumit Saroha** and Sunil Kumar, “Active Power Control of Grid Connected Hybrid Fuel Cell & Solar Power Plant” *International Electrical Engineering Journal* **2015**, 6, 1891-1897.
- [32]. Kapil Dev Sharma, M. Ayyub, **Sumit Saroha** and Ahmad Faras “Advanced Controllers Using Fuzzy Logic Controller (FLC) for Performance Improvement” *International Electrical Engineering Journal* **2014**, 5, 1452-1458.
- [33]. Ajay Kumar, Harjeet Singh, Chitwan Jain and **Sumit Saroha**, “Restructure of Electricity Market in India: A Business Prospective” *International Journal for Scientific Research & Development* **2014**, 2, 866-869.
- [34]. Madhukar Anand, Sonali Khanna, Ravinder Singh and **Sumit Saroha**, “Concept and Formulation of Congestion Management in Electricity Markets” *Journal of Emerging Technologies and Innovative Research* **2014**, 1, 604-608.
- [35]. **Sumit Saroha**, Kratika Sharma, Sanchay Bajpai, Ravi Bhushan Singh, Abhishek Singhal, “Industrial & Home Appliances Control Using GSM Module” *International Journal on Recent Technologies in Mechanical and Electrical Engineering (IJRMEE)* **2018**, 5(5), 68-71.
- [36]. C. Jeeva, **Sumit Saroha**, Akanksha Srivastava, Shruti Sugumar, “Bio Solar Cells Management Systems” *International Journal of Creative Research* **2018**, 6(2), 476-484.
- [37]. C. Jeeva, **Sumit Saroha**, Aman Aditya, Darshak Dhebar, “Tapping The Wave Power of Seas and Oceans using Piezoelectric Crystals on Salter Duck to Generate Electrical Power” *International Journal of Pure and Applied Mathematics* **2018**, 118 (20), 353-361.
- [38]. Kushal Verma, Ishita Gianchandani, **Sumit Saroha**, “Efficient use of Electronic Waste for CNC Machine” *International Journal of Engineering Applied Sciences and Technology*, **2018**, 3 (2), 21-25.
- [39]. C.Jeeva, Sumit Saroha, Yash Upadhyay, Utkarsh Chaturvedi, Umang Kumar, “Existence of Multiverse due to infinite possibilities” *International Journal of Pure and Applied Mathematics* **2018**, 119(12), 13211-13219.

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- [40]. Sumit Saroha, Vineet Shekhar, Preeti Rana, “Cross Border Power Trading and Portfolio in South Asia”, *International Journal for Innovative Research in Science & Technology* **2017**, *4(2)*, pp. 67-71.
- [41]. **Sumit Saroha**, Vineet Singh Bist, Pushan Mohanta, “Enhancement of Efficiency of the Diesel Locomotive using Exhaust Thermal Heat” *International Electrical Engineering Journal* **2018**, 8(1), 2479-2484.
- [42]. **Sumit Saroha**, Amit Rathee and Rohit Verma “JAVA based Power Trading Simulator in Electricity Market” *International Journal of Computer Applications* **2012**, *44*, 8-13.
- [43]. S.K. Aggarwal and **Sumit Saroha** “Electrical Energy Forecasting in Present Day Power System” *Electrical India Magazine* **2015**, *55*, 78-83.

Paper Presented in Conferences and Book Chapters

- [1]. **Sumit Saroha** and S.K. Aggarwal “Multi Step Ahead Forecasting of Wind Power by Different Class of Neural Networks” **IEEE International Conference, RA ECS 2014 at UIET, Chandigarh, 06 - 08 March, 2014.**
- [2]. **Sumit Saroha** and S.K. Aggarwal “Multi Step Ahead Forecasting of Wind Power by Genetic Algorithm based Neural Networks” **IEEE International Conference, PIICON 2014 at Delhi Technological University, Delhi, 05-07 December, 2014.**
- [3]. **Sumit Saroha**, Rohit Verma and Rahmesh Pawar “Cross border power trading Model for South Asian Competitive Electricity Market” **International Conference, DEEM 2011 at Chitkara University, Punjab, 22-23 July, 2011.**
- [4]. **Sumit Saroha** and S.K. Aggarwal “Multi Step Ahead Forecasting of Wind Power by Different Neural Networks” **National Conference, RPTED 2013 at MMU Mullana, Ambala, 19-20 December, 2013.**
- [5]. **Sumit Saroha**, Vinod Kumar “UMCV Forecasting of Indian Energy Exchange Using Artificial Intelligence” **International Conference on Sustainable Computing in Science, Technology & Management, SUSCOM-2019 at Amity University Rajasthan, Jaipur, India, February 26-28, 2019, 737-744.**
- [6]. Anuj Gupta, Kapil Gupta and **Sumit Saroha**, “A review and evaluation of solar forecasting technologies”, *Materials Today: Proceedings*, 2021.
- [7]. **Sumit Saroha**, “Review of Transformer Core and Winding Design with Material Used”, **1st International Conference on Future Trends in Materials and Mechanical Engineering at SRM Institute of Science and Technology, Delhi NCR Campus, Ghaziabad, India, November 6, 2020.**
- [8]. **Sumit Saroha**, “Literature Study of Energy Audit on Heating, Ventilation and Air-Conditioning System”, **1st International Conference on Renewable Energy and Green Technology-Virtual Conference at SRM Institute of Science and Technology, Delhi NCR Campus, Ghaziabad, India, October 6, 2020.**
- [9]. Anuj Gupta, Kapil Gupta, **Sumit Saroha**, “Single Step-Ahead Solar Irradiation Forecasting Based on Empirical Mode Decomposition with Back Propagation Neural Network” **Springer Lecture Notes in Electrical Engineering, Recent Advances in Power Systems, 2022, 812, pp 115-125.**
- [10]. Pardeep Singla, Manoj Duhan, Sumit Saroha, “Different Optimizers-Based Gated Recurrent

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- Unit Network to Forecast One Step Ahead Solar Irradiance”, **Springer Lecture Notes in Electrical Engineering**, Recent Advances in Power Systems 2022, 812, pp 105-114.
- [11]. Pardeep Singla, Manoj Duhan, Sumit Saroha, “One Hour Ahead Solar Irradiation Forecast by Deep Learning Network Using Meteorological Variables”, **Springer Lecture Notes in Electrical Engineering**, Control and Measurement Applications for Smart Grid 2022, 822, pp 103-113.
- [12]. Anuj Gupta, Kapil Gupta, **Sumit Saroha**, “A Comparative Analysis of Neural Network-Based Models for Forecasting of Solar Irradiation with Different Learning Algorithms”, **Springer Studies in Infrastructure and Control**, Smart Structures in Energy Infrastructure 2022, pp 9-18.
- [13]. Anuj Gupta, Kapil Gupta, Sumit Saroha, “Solar Energy Radiation Forecasting Method”, **Springer Green Energy and Technology**, Smart Technologies for Energy and Environmental Sustainability 2022, pp 105-129
- [14]. Pardeep Singla, Manoj Duhan, **Sumit Saroha**, “Solar Irradiation Forecasting by Long-Short Term Memory Using Different Training Algorithms”, **Springer Studies in Infrastructure and Control**, Renewable Energy Optimization, Planning and Control 2022, pp 81-89.
- [15]. **Sumit Saroha**, Sanjeev Kumar Aggarwal, Preeti Rana, “Wind Power Forecasting”, Forecasting in Mathematics-Recent Advances, New Perspectives and Applications 2021, pp 69-85.
- [16]. Pardeep Singla, Manoj Duhan, **Sumit Saroha**, “Solar Irradiance Forecasting Using Elman Neural Network With Different Training Algorithms”, Proceedings of the International Conference on Sustainable Development in Technology for 4th Industrial Revolution 2021 (ICSDTIR-2021) 12 – 13 March, 2021, Chattogram, Bangladesh.
- [17]. Gupta, A., Gupta, K., Saroha, S. (2022). Single Step-Ahead Solar Irradiation Forecasting Based on Empirical Mode Decomposition with Back Propagation Neural Network. In: Gupta, O.H., Sood, V.K., Malik, O.P. (eds) Recent Advances in Power Systems. Lecture Notes in Electrical Engineering, vol 812. Springer, Singapore. https://doi.org/10.1007/978-981-16-6970-5_10.
- [18]. Gupta, A., Gupta, K., Saroha, S. (2022). A Comparative Analysis of Neural Network-Based Models for Forecasting of Solar Irradiation with Different Learning Algorithms. In: Khosla, A., Aggarwal, M. (eds) Smart Structures in Energy Infrastructure. Studies in Infrastructure and Control. Springer, Singapore. https://doi.org/10.1007/978-981-16-4744-4_2.
- [19]. Gupta, A., Gupta, K., Saroha, S. (2022). Solar Energy Radiation Forecasting Method. In: Agarwal, P., Mittal, M., Ahmed, J., Idrees, S.M. (eds) Smart Technologies for Energy and Environmental Sustainability. Green Energy and Technology. Springer, Cham. https://doi.org/10.1007/978-3-030-80702-3_7.
- [20]. Pardeep Singla, Manoj Duhan, **Sumit Saroha**, “Different normalization techniques as data preprocessing for one step ahead forecasting of solar global horizontal irradiance”, Artificial Intelligence for Renewable Energy Systems, Woodhead Publishing Series in Energy 2022, Pages 209-230, <https://doi.org/10.1016/B978-0-323-90396-7.00004-3>
- [21]. Gupta, A., Gupta, K., Saroha, S. (2022). A Review of Machine Learning Models in Renewable Energy. In: Rodrigues, J.J.P.C., Agarwal, P., Khanna, K. (eds) IoT for Sustainable Smart Cities and Society. Internet of Things. Springer, Cham. https://doi.org/10.1007/978-3-030-89554-9_12.

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- [22]. Singla, P., Duhan, M., Saroha, S. (2022). Solar Irradiation Forecasting by Long-Short Term Memory Using Different Training Algorithms. In: Khosla, A., Aggarwal, M. (eds) Renewable Energy Optimization, Planning and Control. Studies in Infrastructure and Control. Springer, Singapore. https://doi.org/10.1007/978-981-16-4663-8_7.
- [23]. Singla, P., Duhan, M., Saroha, S. (2022). One Hour Ahead Solar Irradiation Forecast by Deep Learning Network Using Meteorological Variables. In: Suhag, S., Mahanta, C., Mishra, S. (eds) Control and Measurement Applications for Smart Grid. Lecture Notes in Electrical Engineering, vol 822. Springer, Singapore. https://doi.org/10.1007/978-981-16-7664-2_9.
- [24]. Singla, P., Duhan, M., Saroha, S. (2022). Different Optimizers-Based Gated Recurrent Unit Network to Forecast One Step Ahead Solar Irradiance. In: Gupta, O.H., Sood, V.K., Malik, O.P. (eds) Recent Advances in Power Systems. Lecture Notes in Electrical Engineering, vol 812. Springer, Singapore. https://doi.org/10.1007/978-981-16-6970-5_9.
- [25]. Priti Prabhakar, Mathewos Lolamo, Sumit Maitra, **Sumit Saroha**, Vineet Shekher, "Effect of Forecasting of Wind Speed with input selection Using Artificial Neural Networks" 2nd Deep Learning Indaba X Ethiopia Conference 2021, Januray 27-29, 2022.

Peer Reviewer & Editor for International Journals

- **Editorial Manager, International Journal of Forecasting**
- **IEEE Transactions on Power Systems.**
- **IEEE System Journal**
- **IEEE Access**
- **Intelligent System in Accounting, Finance and Management.**
- **International Transactions on Electrical Energy Systems.**
- **Taylor & Frances for IETE Journal of Research.**
- **Taylor & Frances for Journal of Experimental & Theoretical Artificial Intelligence**

Post Graduate Level Students Guided

- Electrical Energy audit of a building.
- Electrical Energy auditing of Power Distribution System.
- ATC determination of power systems by using Power Transfer Distribution Factors.

Seminar and Workshop Attended

- More than 10 seminars and workshop attended at different platforms.

Summary of my research work

- **Wind Power Forecasting Using Wavelet Transform and Linear Neural Network with Tapped Delay**
With an objective to improve the wind power estimation accuracy and reliability, this article presents Linear Neural Networks with Tapped Delay (LNNTD) in combination with wavelet transform (WT) for probabilistic wind power forecasting in time series framework. For

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comparison purpose, results of the proposed model are compared with the benchmark model, different neural networks and WT based models on the following performance indices such as: accuracy, execution time and R^2 statistic. For the reliability and proper validation of proposed model, this research work highlights the probabilistic forecasts attribute at different skill tests. The historical data of Ontario Electricity Market (OEM) for the period 2011-14 has been used and tested for two years from November 2012 to October 2014.

- **Load Forecasting of Indian Energy Exchange Using Wavelet Based Neural Network**
In order to analyze the nature of electric load demand series in deregulated electricity markets, various forecasting tools has been needed. All these forecasting models have been developed with an objective to improve accuracy within quick simulation time. In with consideration of that, the focus of is to improve the forecasting accuracy within quick simulation time and also consider the seasonal weeks demand series in forecasts. In order to achieve above, first a Wavelet Transform (WT) has been implemented to decompose the demand series into sub-series. Then, WT sub-series have been tested with different neural networks (NN) and best suited decomposition level sub-series has been selected for forecasting. Thus, in this context, hybrid WT pre-processing based neural network model with cyclic one month moving window for two years market clearing volume (MCV) forecasting have been proposed. The proposed models have been effectively implemented on three years (2014-16) Indian Electricity Exchange (IEX) unconstrained MCV (Load Demand) data. The results presented by proposed model are better in terms of accuracy, simulation time and coefficient of regression (R^2) indices.
- **Cross-border Power Trading Model for South Asian Regional Power Pool**
Power sector reform is currently underway in several countries of South Asia. This is noticed mainly in the form of change in the investment and ownership pattern, and increasing role for the private investment, both domestic and foreign. These countries continue to be characterized by low per capita consumption of energy, poor quality of energy infrastructure, skewed distribution and inaccessible and costly energy availability. Interconnection of power systems of contiguously located countries and their coordinated operation provide immense technical and economic benefits. The main issue is to run the system in free and fair manner ensuring quality power to the consumer's at most economical price through safe, secure and reliable operation of the power system resulting in transparent price discovery. Although a number of market models are prevalent in the International arena, the same could not be directly adopted for South Asian Regional power market. This research work focuses on integrating the power Market in South Asia, examining the opportunities, benefits, and challenges. Complexity of electricity market in cross border international model scenario has been analyzed in this paper & a model for South Asian Regional Power Pool has been proposed. Demand and supply side bidding scenarios with case studies has been presented in the paper.
- **A Review and Evaluation of Current Wind Power Prediction Technologies**
The wind power prediction plays a crucial role in operation, planning and real time balancing of power system. A large number of forecasting methodologies has been proposed by the number of research papers since last few decades. This review analyzed new and current developments in the area of wind speed, power & its derivatives (speed or direction) prediction after 2000 & compared in the form of comparative tables concern to the accuracy

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with taken care of variables to be predicted, time horizon, specific application area, data pre-processing, input data selection techniques, data used and various forecasting techniques with their structure. The focus of this review is to facilitate the various issues related to wind power forecasting techniques, emphasis on reduction of complexity of forecasting problem with increase in forecasting accuracy for different time span. The purpose of this is to motivate the power system researchers for designing of new highly accurate online/offline models with concern to different issues regarding wind power resulting in secure reliable power system operation & better utilization of energy resources. It has been observed that from a comparative forecasting accuracy analysis, hybrid models present more accurate results as compare to other models.

- **Hybrid WT-PSO Based Neural Networks for Wind Power Prediction of Ontario Electricity Market**

Wind Power forecasting is an important subject of concern for reliable operations of grid and it has been studied from different points of views of both accuracy and reliability. After considering above aspects this paper presents a hybrid prediction machine for single step ahead wind power in which Wavelet Transform (WT) is used for pre-processing of input wind power data, then the pre-processed data is trained by neural networks. Initially, the parameters are initialized as random & then at second stage are optimized by Particle Swarm Optimization (PSO) base training algorithm. The varying time series input training data patterns are used in order to remove the overtraining & over-fitting problem so that the maximum accuracy is achieved. The results of proposed method are compared with Naive Predictor, Feed Forward Neural Networks (FFNN) & Particle Swarm Optimization based Neural Network (PSO-NN). The results are presented in the form of comparative tables on Mean absolute error (MAE) and mean absolute percentage error (MAPE) scale with emphasis on weekly as well as monthly predictions. The data used by proposed model for estimation is collected from Ontario Electricity Market for the year 2009-12 and tested on one-year data for single step ahead prediction. It is found that the accuracy of proposed model is far better than the other models.

- **Electrical Energy Forecasting in Present Day Power System**

The new developments in the field of electricity forecasting with linear, nonlinear and combined models are increasing from few decades. Nowadays, main concern of the researchers is towards artificial intelligence (AI) and machine learning, ever new models are being proposed at a very fast rate. In this environment, it is important that a review of latest developments in these forecasting areas should be explored for future researchers. Therefore, this paper presents a review of electricity load, price and wind power forecasting.

- **Wind Power Forecasting Using Wavelet Transform and General Regression Neural Network**

The estimation accuracy of wind power is an important subject of concern for reliable grid operations & taking part into open access. So, with an objective to improve the estimation accuracy of wind power, this article presents Wavelet Transform (WT) based General Regression Neural Network (GRNN) with statistical time series input selection technique. The results of proposed model have compared with four different (Naive, Feed Forward Neural Networks, Recurrent Neural Networks & GRNN) benchmark models on Mean absolute error (MAE) and mean absolute percentage error (MAPE) accuracy scale. The

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historical data used by presented models has been collected from Ontario Electricity Market for the year 2011-14 and tested for such a long time period of two years from November 2012 to October 2014 with one-month estimation moving window. This paper also limelight's the simulation time (training & testing) and correlation coefficient of actual wind series with respect to estimated. From the experimental analysis, it has been analyzed that the results produced by proposed model are better than the other benchmark models on all performance indices.

- **Multi Step Ahead Forecasting of Wind Power by Different Class of Neural Networks**
This paper presents a comparison of three different classes of artificial neural networks (ANN) for multi-step ahead time series forecasting of wind power. The neural network needs past wind generation measurement as an input. For time series prediction, the time lag data pattern is required & for this purpose the statistical tool called autocorrelation function (ACF) facilitates to work out on the input variables of neural networks. The three models which have been used are: linear neural network with time delay (LNNTD), feed forward neural network (FFNN) and Elman recurrent neural network (ERNN). The performance comparisons of the models are on the basis of mean absolute error (MAE) & mean absolute percentage error (MAPE). We are collecting the data of wind power from Ontario Electricity Market for the year 2011-2012 and tested for 168 hrs twelve multi-steps ahead forecasting. It's quite interesting to see that all class of neural networks shows almost equal results.

- **Multi Step Ahead Forecasting of Wind Power by Genetic Algorithm based Neural Networks**

In present day scenario statistical (time series) and physical (NWP) models are utilized for wind power forecasting and many of them are using neural networks to obtain greater accuracy of wind power prediction at final stage. In a time, series framework, forecasting is categorized into two ways single step ahead and multi-step ahead. In this paper an advanced time-series model for multi-step ahead wind power prediction based on artificial intelligence techniques is presented. This method requires an input of past measurements for prediction & input is settled on the basis of statistical tool called Auto Correlation Function (ACF). Genetic Algorithms based Neural Network (GANN) and Feed Forward Neural Network (FFNN) trained by Levenberg-Marquardt (LM) training algorithm are employed. Mean absolute error (MAE) and mean absolute percentage error (MAPE) are considered as the performance metric and both models are also compared with persistence model. The data of wind power has been collected from Ontario Electricity Market for the year 2009-12 and tested for one year up to 12 multi-steps ahead forecasting. It has been observed that GANN gives better performance as compared to FFNN.